CLAIM AMENDMENTS AND LISTING

1. (currently amended) A method for creating an optical waveguiding device from an elongated generally annular optical fiber made of glass material and having at least one core and at least one cladding by creating a zone of permanently altered refractive index characteristics in the optical fiber, ~~an optical waveguiding device made of glass material and having at least one core and at least one cladding,~~ using a focused beam which is generated by a ~~focused~~ pulsed laser light source having:

(i) a wavelength greater than the absorption edge of the glass material;

(ii) a pulse width of less than 1 picosecond, and a pulse energy of between 1 nanojoule and 1 millijoule; and

(iii) capable of achieving a peak pulse intensity within a defined focal region;

comprising the steps of:

(a) aligning said laser beam focal region with a defined target region within the ~~waveguiding device~~ optical fiber; and

(b) operating said laser light source with the peak pulse intensity thereof and a repetition rate thereof selected to accumulate heat and to soften the glass material at the target regions and to thereby induce permanent refractive index changes in the ~~waveguiding device~~ optical fiber at the target region.

2. (currently amended) The method according to claim 1 wherein said step (b) comprises the steps of:

(c) reducing said peak pulse intensity to below the threshold for inducing permanent refractive index changes in said optical fiber;

(d) orienting said focal region to be substantially perpendicular to a longitudinal axis of said at least one core;

(e) sweeping said focal region over said ~~waveguiding device~~ optical fiber while measuring multiphoton fluorescence from said at least one core, such that a maximum fluorescence level is indicative of location alignment of said focal region with said at least one core; and

(f) using said orientation and location alignments as spatial references for sweeping said focal region, while setting said peak pulse intensity to at least the threshold for inducing permanent refractive index changes in said ~~waveguiding device~~ optical fiber, to create said zone, said zone having an orientation and location within said ~~waveguiding device~~ optical fiber corresponding to the orientation and location respectively of said focal region.

3. (original) The method according to claim 2 wherein said pulsed laser light source is operated at a pulse repetition rate of between 500 Hz and 1 GHz.

4. (original) The method according to claim 1 wherein said laser light source is a laser system in which the output of a frequency-doubled Erbium-doped fiber laser is amplified in a laser regenerative amplifier that is based on a Ti:Sapphire gain material.

5. (currently amended) The method according to claim 1 wherein said ~~laser light source~~ beam has a ~~beam~~ diameter of from 0.1 to 10~~mm~~ micrometers at the focal region.

6. (original) The method according to claim 1 wherein said focused pulsed laser light is focused with a lens, axicon, focusing mirror, or combinations thereof to achieve desired spatial relationship of the focal region with respect to the target region.

7. (original) The method according to claim 6 wherein said lens, axicon, or focusing mirror has a focal length from 1 to 30mm and a numerical aperture from 0.05 to 1.3.

8. (original) The method according to claim 1 wherein said pulse width is less than 200 femtoseconds.

9. (original) The method according to claim 3 wherein said pulse repetition rate is from 1kHz to 100MHz, said repetition rate being selected based on laser parameters and glass material properties to deliver pulses faster than the thermal diffusion time of the target region so as to allow heat to accumulate and soften the glass material.

10. (cancelled)

11. (original) The method according to claim 1 wherein said peak pulse intensity threshold for inducing permanent refractive index changes is at least 10^{10} W/cm^2.

12. (currently amended) The method according to claim 1 wherein said optical ~~waveguiding device~~fiber is selected from the group of optical ~~waveguiding devices~~ fibers consisting of: ~~an optical waveguide embedded in a glass substrate;~~ a conventional optical fiber; a polarization maintaining optical fiber; an optical fiber with a Germanium enriched core; a hydrogen or deuterium loaded optical fiber; a W-fiber; a multiple cladded fiber; a photonics crystal fiber;~~ a waveguiding device comprised of intersecting at least two optical waveguides~~ intersecting optical fibers; a taper coupler; and a rare earth doped fiber~~, and doped glasses designed for enhanced multiphoton absorption and lower thresholds for femtosecond laser-induced material modification~~.

13. (currently amended) A method for creating an optical waveguiding device from an elongated generally annular optical fiber made of glass material and having at least one core and at least one cladding by creating a zone of permanently altered refractive index characteristics in ~~an optical waveguiding device made of glass material and having at least one core and at least one cladding~~ the optical fiber, using focused beams generated by at least two ~~focused~~ pulsed laser light sources, each having:

(i) a wavelength greater than the absorption edge of the glass material;

(ii) a pulse width of less than 1 picosecond, and a pulse energy of between 1 nanojoule and 1 millijoule; and

(iii) capable of achieving a peak pulse intensity within a defined focal region;

comprising the steps of:

(a) aligning the focal region of each said laser beam with a defined target region within the ~~waveguiding device~~ optical fiber; and

(b) operating said laser light sources with the combined peak pulse intensity thereof and a repetition rate thereof selected to accumulate heat and to soften the glass material at the target regions and to thereby induce permanent refractive index changes in the ~~waveguiding device~~ optical fiber at the target region.

14. (currently amended) The method according to claim 13 wherein said step (b) comprises the steps of:

(c) reducing said peak pulse intensity of each laser light source such that the combination of the peak pulse intensities is below the threshold for inducing permanent refractive index changes in said ~~waveguiding device~~ optical fiber;

(d) orienting each of said focal regions to be substantially perpendicular to a

longitudinal axis of said at least one core;

(e) sweeping said focal regions over said ~~waveguiding device~~ optical fiber while measuring multiphoton fluorescence from said at least one core, such that a maximum fluorescence level is indicative of location alignment of said focal regions with each other and with said at least one core; and

(f) using said orientation and location alignments as spatial references for sweeping said ~~combined~~ focal regions, while setting said peak pulse intensities to bring the combined peak pulse intensities to at least the threshold for inducing permanent refractive index changes in said waveguiding device, to create said zone, said zone having an orientation and location within said ~~waveguiding device~~optical fiber corresponding to the orientation and location respectively of said combined focal regions.

15. (original) The method according to claim 14 wherein each of said pulsed laser light sources is operated at a pulse repetition rate of between 500 Hz and 1 GHz.

16. (original) The method according to claim 13 wherein each of said laser light sources is a laser system in which the output of a frequency-doubled Erbium-doped fiber laser is amplified in a laser regenerative amplifier that is based on a Ti:Sapphire gain material.

17. (currently amended) The method according to claim 13 wherein each of said ~~laser light sources~~ beams has a ~~beam~~ diameter of from 0.1 to 10~~mm~~ micrometers at the focal regions thereof.

18. (original) The method according to claim 13 wherein the focused pulsed laser light from each of said laser light sources is focused with a lens, axicon, focusing mirror or combinations thereof.

19. (original) The method according to claim 18 wherein each said lens has a focal length from 1 to 30mm and a numerical aperture from 0.05 to 1.3.

20. (original) The method according to claim 13 wherein the focused pulsed laser light from each of said laser light sources is focused with reflective optics.

21. (original) The method according to claim 13 wherein said pulse width is less than 200 femtoseconds.

22. (original) The method according to claim 15 wherein said pulse repetition rate is from 1kHz to 100MHz.

23. (original) The method according to claim 13 wherein said peak pulse intensity threshold for inducing permanent refractive index changes is at least 10^{10} W/cm^2.

24. (currently amended) The method according to claim 13 wherein said optical ~~waveguiding device~~ fiber is selected from the group of optical ~~waveguiding devices~~ fibers consisting of: ~~an optical waveguide embedded in a glass substrate;~~ a conventional optical fiber; a polarization maintaining optical fiber; an optical fiber with a Germanium enriched core; a hydrogen or deuterium loaded optical fiber; a W-fiber; a multiple cladded fiber; a photonics crystal fiber;~~a waveguiding device comprised of intersecting at least two optical waveguides~~ intersecting optical fibers; a taper coupler; and a rare earth doped fiber~~; and doped glasses designed for~~

~~enhanced multiphoton absorption and lower thresholds for femtosecond laser induced material modification~~.

25. (currently amended) A method for creating an optical waveguiding device from an elongated generally annular optical fiber made of a glass material and having at least one core and at least one cladding by creating a zone of permanently altered refractive index characteristics in ~~an optical waveguiding device made of glass material and having at least one core and at least one cladding~~ the optical fiber, using focused beams generated by at least two ~~focused~~ pulsed laser light sources, each having:

(i) a wavelength greater than the absorption edge of the glass material;

(ii) a pulse width of less than 1 picosecond, and a pulse energy of between 1 nanojoule and 1 millijoule; and

(iii) capable of achieving a peak pulse intensity within a defined focal region;

comprising the steps of:

(a) combining said laser beam~~s~~ focal regions to create a single ~~laser beam having a~~ focal region;

(b) aligning said single ~~laser beam~~ focal region with a defined target region within the ~~waveguiding device~~ optical fiber; and

(c) operating said laser light sources with the combined peak pulse intensity thereof and a repetition rate thereof selected to accumulate heat and to soften the glass material at the target regions and to thereby induce permanent refractive index changes in the ~~waveguiding device~~ optical fiber at the target region.

26. (currently amended) The method according to claim 25 wherein said step (c) comprises the steps of:

(c) reducing said peak pulse intensity of each laser light source such that the combination of the peak pulse intensities at said focal region is below the threshold for inducing permanent refractive index changes in said ~~waveguiding device~~optical fiber;

(d) orienting said single focal region to be substantially perpendicular to a longitudinal axis of said at least one core;

(e) sweeping said single focal region over said waveguiding device while measuring multiphoton fluorescence from said at least one core, such that a maximum fluorescence level is indicative of location alignment of said focal region with said at least one core; and

(f) using said orientation and location alignments as spatial references for sweeping said single focal region, while setting said peak pulse intensities to bring the combined peak pulse intensity to at least the threshold for inducing permanent refractive index changes in said ~~waveguiding device~~ optical fiber, to create said zone, said zone having an orientation and location within said ~~waveguiding device~~ optical fiber corresponding to the orientation and location of said combined focal region.

27. (original) The method according to claim 26 wherein at least one of said pulsed laser light sources is operated at a pulse repetition rate of between 500 Hz and 1 GHz.

28. (original) The method according to claim 25 wherein each of said laser light sources is a laser system in which the output of a frequency-doubled Erbium-doped fiber laser is amplified in a laser regenerative amplifier that is based on a Ti:Sapphire gain material.

29. (currently amended) The method according to claim 25 wherein each of said ~~laser light sources~~ beams has a ~~beam~~ diameter of from 0.1 to 10~~mm~~ micrometers at the focal region thereof.

30. (original) The method according to claim 25 wherein the focused pulsed laser light from each of said laser light sources is focused with a lens, axicon, focusing mirror or combinations thereof.

31. (original) The method according to claim 30 wherein each said lens has a focal length from 1 to 30mm and a numerical aperture from 0.05 to 1.3.

32. (original) The method according to claim 25 wherein the focused pulsed laser light from each of said laser light sources is focused by reflective optics.

33. (original) The method according to claim 25 wherein said pulse width is less than 200 femtoseconds.

34. (original) The method according to claim 27 wherein said pulse repetition rate is from 1kHz to 100MHz.

35. (original) The method according to claim 25 wherein said peak pulse intensity threshold for inducing permanent refractive index changes is at least 10^{10} W/cm^2.

36. (currently amended) The method according to claim 25 wherein said optical ~~waveguiding device~~ fiber is selected from the group of optical ~~waveguiding devices~~ fibers consisting of: ~~an optical waveguide embedded in a glass substrate;~~ a conventional optical fiber; a polarization maintaining optical fiber; an optical fiber with a Germanium enriched core; a hydrogen or

deuterium loaded optical fiber; a W-fiber; a multiple cladded fiber; a photonics crystal fiber; ~~a waveguiding device comprised of intersecting at least two optical waveguides~~ intersecting optical fibers; a taper coupler; and a rare earth doped fiber~~; and doped glasses designed for enhanced multiphoton absorption and lower thresholds for femtosecond laser induced material modification~~.

37-52. (cancelled)

53. (currently amended) A method for improving coupling between ~~a waveguide~~ an optical fiber and an optical source ~~having characteristic optical mode field properties~~ by modifying the refractive index characteristics of the ~~waveguide~~ optical fiber at or near the interface point by the method of claim 1 to ~~thereby~~ reshape thereby the ~~waveguide~~ optical fiber mode field properties to match ~~those of the source~~ the field distribution created by the source at the interface with the fiber.

54. (currently amended) A method for improving coupling between two ~~waveguides~~ optical fibers having different refractive index profiles and corresponding optical mode field properties by modifying the refractive index characteristics of at least one of the ~~waveguides~~ optical fibers at or near the interface point by the method of claim 1 to reshape the mode field properties of said at least one of the ~~waveguides~~ optical fibers to match the final waveguide mode field properties of the two optical fibers at the interface for one or more wavelengths of operation.

55-57. (cancelled)

58. (currently amended) The method according to claim 1 including the step of positioning a

volume of index matching fluid between said laser light source and said ~~waveguiding device~~optical fiber such that said beam will pass through said fluid prior to reaching said target region.

59. (new) A method for creating an optical waveguiding device from an elongated generally annular optical fiber made of glass material and having at least one core and at least one cladding by creating a zone of permanently altered refractive index characteristics in the optical fiber, using a focused beam which is generated by a pulsed laser light source having:

(i) a wavelength greater than the absorption edge of the glass material;

(ii) a pulse width of less than 1 picosecond, and a pulse energy of between 1 nanojoule and 1 millijoule; and

(iii) capable of achieving a peak pulse intensity within a defined focal region;

comprising the steps of:

(a) applying mechanical stress to said optical fiber;

(b) aligning said laser beam focal region with a defined target region within the optical fiber;

(c) operating said laser light source with the peak pulse intensity thereof and a repetition rate thereof selected to accumulate heat and to soften the glass material at the target region and to thereby induce permanent refractive index changes in the optical fiber at the target region; and

(d) removing said mechanical stress once said zone of altered refractive index characteristics has been created.

60. (new) A method for creating an optical waveguiding device from an elongated generally annular optical fiber made of glass material and having at least one core and at least one cladding

by creating a zone of permanently altered refractive index characteristics in the optical fiber, using a focused beam which is generated by a pulsed laser light source having:

(i) a wavelength greater than the absorption edge of the glass material;

(ii) a pulse width of less than 1 picosecond, and a pulse energy of between 1 nanojoule and 1 millijoule; and

(iii) capable of achieving a peak pulse intensity within a defined focal region;

comprising the steps of:

(a) applying an electric field to said optical fiber;

(b) aligning said laser beam focal region with a defined target region within the optical fiber;

(c) operating said laser light source with the peak pulse intensity thereof and a repetition rate thereof selected to accumulate heat and to soften the glass material at the target region and to thereby induce permanent refractive index changes in the optical fiber at the target region; and

(d) removing said electric field once said zone of altered refractive index characteristics has been created.